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IS 10746-1 (1983): Shell and Tube Type Marine Heat Exchangers, Part 1: Application Standard [TED 19: Marine Engineering and Safety Aids]

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Indian Standard (Reaffirmed 2004)

SPECIFICATION FOR SHELL AND TUBE TYPE MARINE HEAT EXCHANGERS

PART 1 APPLICATION STANDARD

1. Scope — Specifies typical features and applicable data for various marine heat exchangers.

2. Typical Features — The typical features, such as materials, construction, thermal performance, etc, of various marine heat exchangers are given in Table 1.

EXPLANATORY NOTE

Heat exchangers are used throughout the marine power plant to transfer heat from one fluid (liquid or gas) to another fluid. The most widely used type of heat exchangers in marine service is the 'shell and tube' type.

Due to stringent space limitations imposed on marine heat exchangers and for ease of maintenance and cleaning, head inlet and outlet connections are arranged to permit access to the tubes and tube sheets without dismentling the attached piping.

Marine Engineering Sectional Committee, MCPD 3; Heat Exchangers and Fittings Subcommittee, MCPD 3 : 3 [Ref : Doc : MCPD 3 (573)]

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

TABLE 1 TYPICAL FEATURES OF MARINE HEAT EXCHANGERS

Type→		Lubricating Oil Cooler	Low-Pressure Feed Heater	High Pressure Feed Heater	Tank Cleaning System		Gland Leakoff Condenser	Contaminated Steam Generator	Lubricating Oil Heater	Fuel Oil Heater	Electronics Equipment Cooler	Boiler Water Sample Coolers	Water Heaters	Fresh Water Cooler
Item ↓					Heater	Drain Cooler (Aux. Condenser)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Tube Side	Fluid	Sea water	Feed		Sea water		Feed	Steam	Steam	Steam	Chilled water or seawater	Boiler make-up water	Water	Sea water
	Velocity, m/s	1·8 – 2·1	1·2 – 2·1		1·8 – 2·1		0·9 – 1·2	—	—	—	0·9 – 1·8	0·3 – 2·4	1·2 – 2·1	1·8 – 2·1
	No. of passes	1	2—8		1—4		2	2	1	1	1	1	1	1
	Tube size	16 mm OD × 1·2	16 mm OD × 1·2	16 mm OD × 1·2	20 mm OD × 1·2		16 mm OD × 1·2	25 mm OD × 1·5	12-16 mm OD × 1·2	12-16 mm OD × 1·2	16 mm OD × 1·2	6 mm OD × 0·8	16 mm OD × 1·2	16 mm OD – 1·2
	Tube material	90/10 CuNi	90/10 CuNi	70/30 CuNi	90/10 CuNi		90/10 CuNi	90/10 CuNi	Steel	Steel	90/10 CuNi	90/10 CuNi	90/10 CuNi	90/10 CuNi
	Head material	Bronze with sacrificial anodes	Steel	Steel	Steel		Steel	Steel or 90/10 CuNi	Cast steel	Cast steel	Bronze	—	90/10 CuNi	Bronze with sacrificial anodes
	Tube sheet	90/10 CuNi	Steel	Forged steel	Bronze, Naval Brass or Equivalent		Steel	Bronze or steel	Steel	Steel	90/10 CuNi or bronze	—	Admiralty brass	Aluminium brass or 90/10 CuNi
Shell Side	Fluid	Oil	Steam		Steam	Heater drains	Gland steam	Fresh water	Lubricating oil	Fuel oil	Fresh water	Seawater	Steam	Fresh water
	Velocity, m/s	0·6 – 0·9	—		—	—	Condensing	—	0·6 – 0·9	0·6 – 0·9	0·9 – 1·5	0·3 – 2·4	—	1·8 – 2·1
	No. of passes	10–16 (baffled)	6 (baffled)		6 (baffled)	12 (baffled)	5 or 6 (baffled)	Open shell	1 (baffled)	1 (baffled)	1 (baffled)	None	1 (baffled)	1 (baffled)
	Type of baffle	Segmental	Segmental		Segmental		Segmental	None	Segmental	Segmental	Segmental	None	Segmental	Segmental
	Flow	Counter flow	—		—	Counterflow, last pass	Counterflow, last pass	Boiling	Counterflow	Counterflow	Counterflow	Counterflow	—	Counteflow
Construction	Tube joint	Expanded	Expanded	Expanded or welded	Expanded		Expanded	Expanded	Expanded	Expanded (outer) ferrulus (inner)	Expanded	Welded or brazed	Expanded	Expanded
	Thermal expansion	Floating tube sheet	Expansion joint	U-tubes	U-tubes or floating tube sheet		—	Floating head or U-tube	Floating tube sheet	Floating tube sheet	—	—	U-tubes or floating tube sheet	Floating tube sheet
	Gasket	Full face	Ring or flexible	Ring (shell side) Solid copper ring (tube side)	Full face		Full face	Full face	Ring	Ring	Ring	Full face	Ring	Ring
	Bolting	Collar bolts	Stud bolts		Collar bolts		Stud bolts	Stud bolts	Stud bolts	Stud bolts	Stud bolts	Stud bolts	Stud bolts	Collar bolts
	Surface	Bare	Bare		Bare		Bare	Bare	Bare	Bare	Bare	Bare	Bare	Bare
Thermal Performance	Heat transfer coefficients kcal/m^2.h. °C	195	3 900		2 930	980	—	—	Purifier 49 – 98 Warm up 293	220	1 950	2 440	2 240	1 000
	Surface requirement	15–20 l/min lubricating oil per m^2	1 465 – 2 200 kg feed per hour per m^2		132 l/min seawater per m^2	880 kg drains per h/m^2	29 – 49 kg steam per h per m^2	150 – 240 kg steam per h per m^2	294 – 391 l/h per m^2 3 670 l per h per m^2	342 – 587 l/h per m^2	7 340 l/h per m^2	12 l/min boiler water per m^2	7 340 l/h per m^2	—
	Terminal temperature difference	5°C, *Max*	5·5°C		105°C	55·5°C	11°C	44·5°C	80°C	70°C	11°C	222°C	70°C	8 – 9°C
	Temperature change	11°C drop in lubricating oil	55·5°C rise in feed		61°C rise in seawater	111°C drop in drains	Cools non-condensable gases to about 60°C	Boiling at 7 kg/cm^2 abs	60°C 28°C	80°C	2·8°C drop in fresh water	222°C drop in sample temperature	70°C	20°C

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